

# Open Research Online

---

The Open University's repository of research publications and other research outputs

## Water Efficiency: the contribution of construction products

### Book

#### How to cite:

Thornback, Jane; Snowden, Carmen; Anderson, Jane and Foster, Chris (2015). Water Efficiency: the contribution of construction products. London: Construction Products Association.

For guidance on citations see [FAQs](#).

© 2015 Construction Products Association

Version: Version of Record

Link(s) to article on publisher's website:

<https://www.constructionproducts.org.uk/publications/sustainability/water-efficiency-the-contribution-of-construction-products/>

---

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online's data [policy](#) on reuse of materials please consult the policies page.

---

[oro.open.ac.uk](http://oro.open.ac.uk)

# Water Efficiency

the contribution of construction products

2015

---



#### PLEASE NOTE

The information contained herein has been prepared by the Construction Products Association and represents the views of the Construction Products Association without liability on the part of Construction Products Association and its officers

Whilst every effort has been made to check the accuracy and quality of the information given in this publication, neither the Author nor the Publisher accept any responsibility for the subsequent use of this information, for any errors or omissions that it may contain, or for any misunderstanding arising from it.

The Publication was written by  
Jane Thornback, Construction Products Association  
Carmen Snowdon, WRc plc  
Jane Anderson, PE International  
Chris Foster, EuGeos

#### Acknowledgements

We would like to thank all those who have provided their invaluable help and support in the production of this publication

© 2015 Construction Products Association

ISBN 978-1-909415-10-2

# water efficiency

the contribution of construction products

# contents

<b>Executive Summary</b>	I
<b>1. Introduction</b>	3
Water resources in the UK and their exploitation	4
Water availability in the UK	5
The built environment and water resources in the UK	6
<b>2. Water usage in construction product manufacturing</b>	7
Sources of water for use in manufacturing	7
Managing water use in construction product manufacturing	9
Water management - some industry examples	10
Is water availability a business risk for manufacturers?	12
<b>3. Construction products and water management in the built environment</b>	15
Types of construction products and their role in water management	15
a) Products that help reduce water use in buildings	16
b) Products that enable building occupiers and infrastructure managers to recycle water or use alternative sources	19
c) Product systems that channel or soak up rainwater (runoff)	20
d) Products that enable other manufacturers and construction contractors to reduce water use in their processes	22
<b>4. Water use, energy and carbon</b>	23
The link between water, energy and carbon	23
The water/energy balance in manufacturing	24
<b>5. Measuring water and assessing environmental impacts</b>	26
Measuring and reporting water associated with construction product manufacturing	27
Embodied water of construction products	27
Water footprinting	29
The future of water reporting	30
<b>Annexes</b>	31
Environmental product declarations (EPD) and related standards	31
Advice on water measurement in EPD from technical committee TC 350	33
Guidance for the householder on ways to reduce water usage	35

## Executive summary

- 1 This publication is about the role that construction product manufacturers have on managing water use and water efficiency. It discusses the ways in which manufacturers use water during the manufacturing phase and the innovations they are making to use water more efficiently as well as the types of products that manufacturers produce that assist others in the built environment to manage water. It discusses the potential business risk to increasing scarcity of water, as well as the interaction between water, energy and carbon emissions. Finally it discusses the ways to measure and assess water use and its impact. Examples and case studies from the construction product manufacturing sector are provided.
- 2 Water is an essential resource but pressures on freshwater resources across the globe are growing due to population growth, increased industrial activity, urbanisation and changing lifestyles. The UK is not immune to these pressures. Parts of England are now classified as under severe water pressure and receive less water per person than parts of the Mediterranean. Whilst concern is usually on water scarcity, the increasingly volatile weather patterns in the UK are causing regular, often severe, flooding (five of the wettest years on record have been since 2000); for manufacturers both scarcity and flooding can pose a business risk.
- 3 In the UK, the built environment is a major user of water resources. Water is used throughout the construction life cycle, from the extraction of raw materials, in the manufacturing phase, during the construction phase, and obviously in the use phase in homes, offices, schools, hospitals, hotels etc. Finally water is a resource often used in the demolition process. Currently, most water use in the UK is during the in-use phase of buildings and is regulated by the Building Regulations Approved Document G in England and Wales and by Standard 3.27 of Building Standards in Scotland. Drainage from buildings have separate standards.
- 4 Construction product manufacturers use water in a wide variety of ways throughout their manufacturing processes. Water can serve as a lubricant, a cleaning agent, a sealant, a heat transfer medium, a solvent, an air pollution control medium and an array of other uses depending on the materials and products being produced. Different uses of water for manufacturing purposes may also have different requirements for water quality (purity, dissolved materials content) and quantity.
- 5 The principal source of water for manufacturing is from the public mains supplied by a water company. A secondary source is directly abstracted water from either a river or ground source, this requires an abstraction license and is especially important for some sectors such as for mineral and aggregate extraction. Other important back up sources of water are harvested rainwater such as collected on site perhaps in tanks from roof run-off. Recycled water plays a part where it can be reused from one process into a second process. Use of water by manufacturers may be described as consumptive i.e. the water is used on site but not retained on site, for instance water in staff toilets is usually flushed away down the sewer, or else non-consumptive use which means the water is used but is returned to the source from which it is drawn. These differences have repercussions on the way water usage and impact is measured.
- 6 Whilst manufacturers use water, they also produce the products that help others in the built environment manage water better. There are four broad groups of construction products that facilitate better water management: those that help reduce water use in buildings, those that enable home and building owners to recycle water or use alternate sources to mains water, and products that channel rainwater runoff. There has been much innovation in recent years in all these product groups. For instance, considerable research has gone into creating showers that maintain the sense of water pressure whilst decreasing the actual amount of water used. New paving has been developed to manage in a controlled way surface water run-off, it allows for hard standing but enables water to drain away rapidly; an important attribute as the nation's front gardens get paved over for cars. The Water Label has been brought in across Europe to help consumers identify water efficient products.

- 7 The pumping, treating and heating of water all require energy and thus, depending on the source of energy, may have associated implications for emissions of carbon dioxide and other greenhouse gases. This will be specific to the type of manufacturing sector and also, in many cases, will be site-specific. The quality of water required for a manufacturing process will influence the need for treatment, whilst the characteristics of the water (e.g. temperature) may drive efficiency in recycling the water. A good water management strategy and action plan can help identify where energy use can be lowered thereby reducing emissions and also saving money. Often this is a balance between competing needs.
- 8 Manufacturers measure their water usage at the factory level mainly because they have to pay for the mains water they use. Measurement of water abstracted and of effluent leaving a site is also increasingly common. Those with environmental permits have to report their water usage to the appropriate agency. Methods to measure net freshwater usage for products (an environmental profile) have existed for several decades and have recently been harmonised into a European standard (EN15804) for producing Environmental Product Declarations. Corporate reporting standards such as the Global Reporting Initiative (GRI) require reporting of overall water usage. Whilst these measures provide useful impact information especially on net water usage, they do not necessarily identify the location of the source of water or the quality of that water. A litre of water consumed from Manchester has less significance than a litre of water from Sudan. Terms such as embodied water or water footprinting therefore have to be scrutinised as to what they cover. An international water footprinting standard ISO 14046 was published in 2014 though the issues are both conceptually complex and equally difficult to conceive how they would work in practice.
- 9 This publication on the role of water usage by manufacturers and distributors sits alongside a programme of work by UK-based contractors to decrease the use of water on construction sites during the construction phase. Both contribute to a campaign by the wider UK construction community to improve the efficiency of resources, in this instance water, and to decrease carbon emissions. As such this work, conceived and coordinated by the Construction Products Association, is a contribution to the activities of the joint industry and government's Green Construction Board via its Greening the Industry Working Group.

Jane Thornback  
Construction Products Association  
April 2015

# I. Introduction

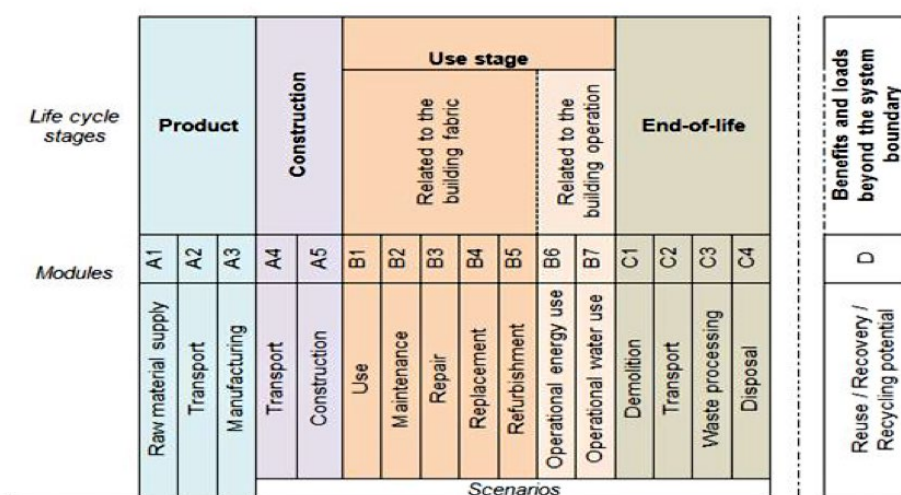
Fresh water resources across the globe are coming under increasing pressure from population growth, rising per capita water use, urbanisation and increased industrial activity. These pressures, and the risks the lack of adequate water of a suitable quality poses for people, industry and ecosystems, are highlighted in a growing number of reports at international, EU and UK levels. The 2014 World Economic Forum Report lists water availability as one of its top ten risks<sup>1</sup>. In 2012, the EU<sup>2</sup> published its Blueprint to Safeguard Europe's Water Resources<sup>3</sup> which sets out a number of policy options and actions, and in 2011, a water white paper for England and Wales, *Water for life*<sup>4</sup>, highlighted the challenges facing the water sector, including maintaining water supplies, keeping bills affordable and reducing regulation. These concerns are before any consideration of the potential impact of climate change on weather patterns and water resources.

In Europe, the construction and the use of buildings accounts for about a third of all water use<sup>5</sup> and in the UK, the built environment is a major consumer of water resources, (WRAP 2011<sup>6</sup>). Water is utilised throughout the construction life cycle (see Figure 1), from the extraction of raw materials to make products, through manufacturing, the construction process and in the use phase of buildings for bathing, cooking, cleaning, heating etc and at end of life water may be used during the demolition process especially to suppress dust. How the construction sector uses water, the products it puts into buildings and infrastructure and how consumer behaviour is influenced by regulation and the availability of innovative products and processes is therefore highly important.

Water is a vital resource for the construction product manufacturing sector in the UK. The purpose of this publication is to improve understanding amongst the wider construction industry and policy makers of the ways in which water is utilized in manufacturing processes and the range of efficiencies being adopted and pioneered by the sector. It also describes the types of manufactured products that enable others in the built environment, including consumers, to manage water more effectively. In addition, the report discusses the potential business risk of increasing water scarcity and the interaction between water, energy use and carbon emissions. Finally it discusses the ways to measure and assess the environmental impact of water use and consumption. Examples and case studies from the construction product manufacturing sector are provided.

This report, on water usage by manufacturers and distributors, sits alongside a programme of work by UK-based construction contractors to decrease the use of water on construction sites during the construction phase. Both contribute to a campaign by the wider UK construction community to improve the efficiency of resource use, in this instance water, and to decrease carbon emissions. As such this work, conceived and coordinated by the Construction Products Association, is a contribution to the activities of the joint industry and government's Green Construction Board via its Greening the Industry Working Group.

Figure 1. Construction life cycle stages as defined in the European standard EN 15978.



1 [http://www3.weforum.org/docs/WEF\\_GlobalRisks\\_Report\\_2014.pdf](http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2014.pdf)

2 <http://www.eea.europa.eu/publications/european-waters-assessment-2012>

3 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0673:FIN:EN:PDF>

4 <http://www.official-documents.gov.uk/document/cm82/8230/8230.pdf>

5 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Resource Efficiency Opportunities in the Building Sector: COM(2014) 445 final.

6 <http://www.wrap.org.uk/content/freshwater-availability-and-use-uk-0>

# Water resources in the UK and their exploitation

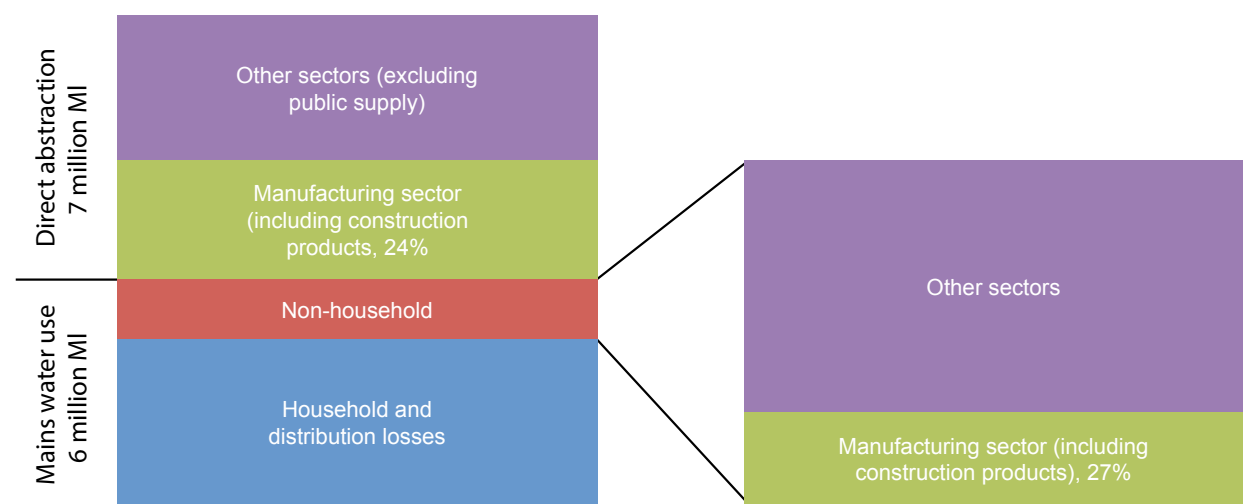
The water industry in the UK collects, treats and supplies more than 17 billion litres per day of water to domestic and commercial customers and then collects and treats more than 16 billion litres of the resulting wastewaters, returning it safely to the environment (Water UK, 2014).

Two-thirds of the UK's mains water supply comes from surface sources and a third from groundwater although this varies by region. The water industry draws water from more than 1,500 boreholes, 650 reservoirs and at 600 river abstraction points<sup>7</sup>. In 2012, almost 13 million MI<sup>8</sup> of freshwater was abstracted from the environment.

Figure 2 illustrates how this water is used by homes and businesses either directly, or via mains water supply (WRAP 2011<sup>9</sup>). These proportions reflect 'consumptive' use by consumers, i.e. water which is not immediately returned to the environmental source from where it was abstracted.

Construction product manufacturing makes up around 15% of all manufacturing (by scale of industry in output), so a crude extrapolation equates this sector with using just over half a million MI of water per year.

Figure 2. Water use in homes and businesses either directly, or via mains water supply in a year MI (WRAP 2011<sup>9</sup>)



7 Water; UK 2013 and Water; UK 2014  
8 <https://www.gov.uk/government/statistical-data-sets/env15-water-abstraction-tables>  
9 <http://www.wrap.org.uk/content/freshwater-availability-and-use-uk-0>



## Water availability in the UK

Whilst we tend to think of the UK as immune to water scarcity pressures, in reality parts of England now have less rainfall per person than parts of the Mediterranean<sup>10</sup>.

The latest analysis by the Environment Agency of water availability in England and Wales based on the Water Exploitation Index (2013) reveals areas right across the country at future risk of water scarcity (Figure 3). Several water suppliers in the UK already report water deficiencies within their regions. Attention therefore is inevitably turning to how to manage water more efficiently and reduce demand on supplies.

### Water Exploitation Index

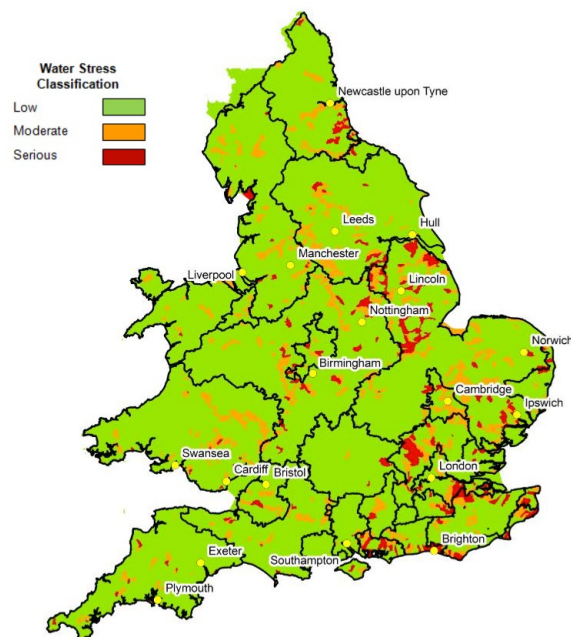
Within England and Wales areas at risk of water stress have been identified by the Environment Agency using the Water Exploitation Index (WEI+) developed by the European Environment Agency:

$$\text{WEI+} = \frac{\text{Abstraction} - \text{Returns (Discharges)}}{\text{Natural Water Resource} - \text{Artificial storage}}$$

The result of the WEI+ is the net abstraction as a percentage of the total resource. Using thresholds based on environmental screening requirements, the WEI+ result for each water body is classified into three water stress categories: Low, Moderate and Serious, indicating the level of stress placed on the water environment by the use of water through abstraction, discharge and management of storage.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/244333/water-stressed-classification-2013.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/water-stressed-classification-2013.pdf)

Figure 3. The map shows final water body stress classification at a water body scale across England and Wales. This classification takes into account four possible pictures of the 'future' including impacts from changing demands and population growth, or a changing climate. (Image from EA (2013).



<sup>10</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/228861/8230.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228861/8230.pdf)

## The built environment and water resources in the UK

The built environment is a major consumer of water resources in the UK<sup>11</sup>. Most water use occurs during the in-use phase of buildings, i.e. the water we use in our homes, offices, schools, hospitals, shops, hotels etc. This is called “**operational water**” and has been increasing per capita over the past few decades. This water use in buildings is regulated by the Building Regulations Approved Document G in England and Wales and Standard 3.27 of the Building Standards Technical Handbook in Scotland. Approved Document G has been increasing the requirement for water efficiency and now stipulates a volume of 125 litres of water per day per person. Chapter 3 provides a synopsis of the types of products produced by construction product manufacturers to assist in improving water efficiency, both in buildings and to help manage water surface runoff.

The other main water impact by the construction sector is in the manufacture of construction products. This is the water used in the manufacturing process and thus embodied within construction products; hence it is called “**embodied water**”. Chapter 2 discusses the many ways that water is used within manufacturing processes. Requests for information on the embodied water of construction products is increasing, (often because the profile of embodied water has been highlighted as an issue in global food production supply chains). How the construction product manufacturing sector measures and reports water usage, including the measurement of embodied water, is discussed in Chapter 5 on measurement.

Although water remains a comparatively low cost resource in the UK, many manufacturers have sought to improve the efficiency of water use in their manufacturing processes as part of general efficiency gains. Those manufacturing water-related products, such as taps, baths or drainage and soakaway products, are responding to regulatory and market drivers to provide the new products to enable others to manage their water resources better.

Potential water scarcity issues in parts of the UK is however of growing concern to manufacturers and there is increasing awareness of the business risk posed by possible water restrictions, this is discussed in Chapter 2.

---

<sup>11</sup> <http://www.wrap.org.uk/content/freshwater-availability-and-use-uk-0>

## 2. Water usage in construction product manufacturing

Manufacturers of construction products rely on water for a wide variety of purposes. Water can serve as a lubricant, a cleaning agent, a sealant, a heat transfer medium, a solvent, an air pollution control medium plus an array of other uses depending on the material and products being produced. Water must of course also be supplied for staff welfare purposes on any industrial or commercial site, i.e. via the provision of toilets, showers, basin taps and kitchen facilities.

Different uses of water for manufacturing purposes may also have different requirements of water quality (purity, dissolved material content etc). For instance some dust suppression activities can use non-potable water; whereas there are strict requirements for drinking water which cover micro-organisms, chemicals and metals as well as the way the water looks and tastes<sup>12</sup>.

Figure 5 gives examples illustrating a variety of water uses by different construction product manufacturing processes and the different water qualities required.

### Sources of water for use in manufacturing

The four main sources of water for use in construction product manufacturing in the UK are:

- **Mains water, supplied by a water company**

Mains water accounts for the biggest proportion of water use overall, with alternative sources used as backup to guarantee security of supply<sup>13</sup>.

- **Directly abstracted water from either a river or groundwater source**

The abstraction of water directly from freshwater surface or groundwater sources requires a licence from the relevant environmental regulator (Environment Agency, Natural Resources Wales, Scottish Environment Protection Agency, or the Northern Ireland Environment Agency). Many companies have an abstraction license, especially those in the heavy industries such as aggregates, concrete and bricks.

- **Harvested rainwater, collected on site, perhaps in tanks from roof run-off, in lagoons from site run-off, or from de-watering activities on site**

Rainwater harvesting is becoming more common across the sector though tends not to be relied upon to supply significant proportions of water. This may be due to lack of constant supply, since seasonal variations in rainfall mean there is usually a reliance on mains water to 'top up' the available rainwater supply, or because of the treatment required to achieve the required water quality for wider use. Less commonly used sources of harvested water include quarry water and site lagoons which can be developed on a site by site basis.

- **Recycled water – where water from one process is later used in another process**

The use of recycled water is widespread amongst construction product manufacturers; half of all respondents to a 2013 industry survey<sup>13</sup> already recycle water. Whilst mains water is still the primary water source for respondents, almost a quarter indicated that recycled water is the main source of process water.

---

<sup>12</sup> <http://dwi.defra.gov.uk/consumers/advice-leaflets/standards.pdf>

<sup>13</sup> CPA survey of members (2013)

## Figure 5. Examples of water use in a variety of different construction product manufacturing processes

- **Pre-cast concrete** and other **cement-based products** are often steam-cured. Water used for steam production needs to have very low levels of dissolved solids and dissolved oxygen to prevent scale formation and corrosion in the boiler, both of which reduce efficiency and operating life - in turn raising energy and maintenance costs. So mains water is treated to remove scale-forming solids and dissolved oxygen to provide boiler feed water. In steam-curing of cement-based products, steam provides both heat and water that becomes incorporated into the product.
- In many chemical processes, such as those that produce **plastics and resins**, steam is passed through heat exchanger circuits to provide the heat needed for chemical reactions. In such "closed systems", nearly all of the condensed steam ("condensate") is returned to the boiler to be used again, so the need for fresh, treated water is much reduced.
- Plastic products such as **rainwater goods** are made by moulding polymer resins under pressure. The forces acting on the plastic in the process cause it to heat up, so here water is used to cool equipment and prevent overheating. Like steam, cooling water is often circulated through closed systems, with unwanted heat transferred to the atmosphere or a refrigerant. Some cooling systems disperse waste heat by allowing the water to evaporate in a cooling tower - these open, or semi-closed, systems consume more water than closed systems. Like boiler feed water, cooling water must be treated - in this case to prevent corrosion and formation of biofilms, both of which reduce cooling efficiency, and, where there are cooling towers, to control the growth of legionella.
- In **wood panel manufacturing**, water is used for resin preparation, for spraying and humidifying after matt forming, for waste wood cleaning and also for emission abatement. Water use varies between the different board types. In the production of fibres (such as for MDF) the refining of fibres increases the overall water consumption of manufacture. For MDF, even if water is recycled, there is a need for the addition of fresh water during the refining step. Typical water consumptions for wood panels are given in European IPPC Bureau (2013) Draft Best Available Techniques (BAT) Reference Document for the Production of Wood-based board.
- In **ceramics**, water is used for a number of purposes including mixing and shaping - this water is later evaporated in dryers - as a raw material for the body and glazes, as a washing fluid and as a cooling medium. Good quality water is required for preparation of clays and glaze slips; clay bodies for extrusion and 'muds' for moulding; preparation of spray dried powders; wet grinding/milling; and washing operations. Low quality water, such as untreated process water from washing operations in the glaze section, can be suitable for the other activities.
- The main uses of water in the **glass** industry are for cooling, cleaning and batch humidification. Flat glass, such as used for windows, is normally produced in a continuous ribbon and most water is used for cooling and washing this hot ribbon. For continuous filament glass fibre, as found in some insulation products, water use is to cool filaments rapidly from around 1250°C to ambient. Cooling system losses can account for around 20% of water consumption. Water is also used in coating preparation and later stages of production. Typical water consumptions for continuous filament glass fibre are given in Joint Research Centre of the European Commission (2013) Best Available Techniques (BAT) Reference Document for the Manufacture of Glass as 4-15m<sup>3</sup> input per tonne product. Up to 25% of input water is evaporated, but leading manufacturers now achieve overall water consumption well below 4m<sup>3</sup> per tonne product.
- In **coatings**, water is a key **product ingredient**. Water-based paints are a basic material for many types of building. Water used in paint needs to be clean and free of particles, so mains water is normally used.
- In **quarries**, water is used to clean stone products, for vehicle washing and dust suppression. Water is also used for mineral washing, for lubrication and cooling of saws and other cutting equipment. Much of a quarry's water demand can be met through dewatering and rainwater collection; however some uses - such as product washing and block or concrete production require clean water. Water used to clean product can also be cascaded or used in counter-current systems to reduce the total volume required. It is usual to find cement works located in, or near chalk and limestone quarries; brickworks located on or near clay pits; asphalt plants located on or near hard rock aggregate quarries. Evaporative drying, (e.g. in the production of asphalt and specialist silica sands), evaporation from washed aggregate stockpiles and other wet surfaces, water incorporation in products, dust suppression and vehicle washing activities represent consumptive use. To reduce net consumption, many quarries collect water used for vehicle washing and dust suppression and recirculate it through site lagoons for further processing on site.
- For production of **steel**, water is used for direct and indirect cooling, gas cleaning, scale breaking and washing operations including waste gas cleaning with scrubbers. There can be various water systems in operation: completely closed, semi-closed or open circuits. Closed circuits can be used, e.g. for cooling circuits operated with demineralised or softened water at specific installations such as for continuous casting moulds.
- All businesses use water for **welfare purposes**. Staff require water for drinking, toilet and urinal flushing and washing hands. Many businesses also contain kitchens and sometimes showers. Generally mains water is used for these purposes, although it is possible to use water of lower quality for toilet and urinal flushing.

## Managing water use in construction product manufacturing

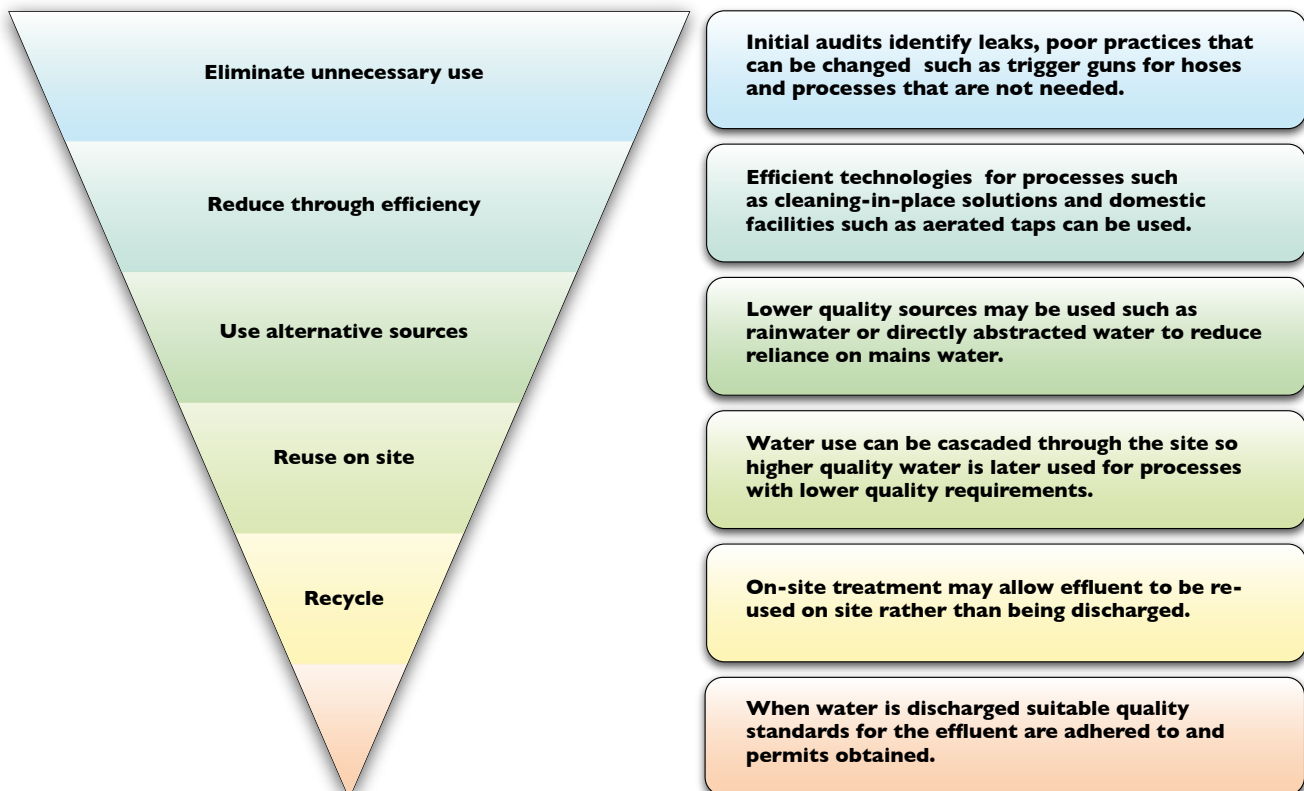
In the UK, water availability for much of our industrial history has not been a limiting factor and water has not been thought of as a scarce resource. Also, compared to energy or raw materials, water remains a relatively inexpensive commodity. The incentives for improving the efficient use of water have therefore not been as strong as those focused on the use of energy. Concerns over water have traditionally been about its purity, cleanliness and pollution load especially emanating from sewerage or industrial effluent discharge and most of the regulation that has built up around water has concerned these issues. The result has been very positive with a major cleaning up of rivers, such as the Thames and Mersey, and cleaner beaches, seawater and other water bodies.

The efficient use of water is however climbing up the manufacturing agenda and many manufacturers are implementing ways within their processes to use water more wisely - as part of general efficiency gains. In addition, those who manufacture water-related products have been researching and innovating to create the new products that will help others to manage water better; for instance low flow showers, low spray taps and drainage products such as permeable paving and sustainable drainage systems, especially important with the increase in flooding experienced in many parts of the UK, such as in 2014.

For any business, however, any measures to improve efficiency have to be justified in terms of business benefits, and for water, the low cost remains a weak driver for change. But a more pressing business concern is beginning to emerge – that of the future availability of water and the potential business risk posed by possible restrictions of water in the future; this topic is discussed later in this chapter.

The increasing focus on water management over the last fifteen years has led to advice being developed as to how to think about and manage water resources. A **water hierarchy** has emerged identifying different levels of water management (similar in concept to the waste hierarchy developed under the EU Waste Framework Directive). Figure 6 illustrates the water hierarchy, followed by examples of its application.

Figure 6. Water hierarchy for manufacturing



## Water management - some industry examples

Many construction product manufacturers in the UK implement aspects of the water management strategies highlighted within the water hierarchy. Different levels within the hierarchy can often be used together and reinforce one another. The following examples illustrate how some manufacturers are managing their water resources.

### **Structured water management – Hanson**

Hanson has implemented a structured approach to water management. In 2009, it set business line targets for concrete and building products to reduce water consumption per tonne produced by two per cent by the end of 2012. It also employs specialist consultants to help reduce water consumption and save money. The service includes water audit, leak detection and repair, bill validation and data logging.

The 2012 target was exceeded in concrete, which fell by seven per cent, but was missed by building products, which rose by over 14 per cent. This was because Hanson now make fewer aggregate blocks, which have a lower water intake.”

Hanson reduced overall water consumption from 10,192MI in 2009 to 9,266 in 2012.

*Hanson Performance and Sustainability Report.* <http://2014.hanson-sustainability.co.uk/water-and-biodiversity/>

### **Reducing water use through efficiency – Knauf**

Water is a key ingredient in the manufacture of plasterboard, but is evaporated when the finished product is dried. During a regular recipe review, Knauf realised it could improve the efficiency of key processes in the manufacture of its plasterboard and save both water and energy. Adjusting the proportion of chemical liquefier in the stucco allowed water content to be reduced. At its Sittingbourne plant in Kent, 100 tonnes of water per day has been saved as a result. The board drying is the most energy-consuming part of the plasterboard manufacturing process, so less water to evaporate has also meant energy savings and 12.8 million kWh of gas per annum has been saved across the Sittingbourne and Immingham sites combined, based on 2013 production volumes.

<http://www.knauf.co.uk/about-us/sustainability>

### **Using alternative sources - rainwater harvesting - Hanson - steam condensing tanks**

A rainwater harvesting system at the Hanson Thermalite aircrete block works at Hams Hall in the West Midlands has a double benefit in terms of reducing water use.

The system collects the rainwater from the factory's large expanse of pitched roofs and channels it into a large diameter pipe. The pipe is linked to a collection tank where steam from the autoclaves is condensed back into water for reuse.

By using the rainwater to cool the condensate steam, more process water can be used as the water in the reclaimed tank is closer to the required temperature for reuse in the production process. This also reduces the amount of mains water required to cool the condensate steam, thus saving money.

*Hanson Performance and Sustainability Report.* <http://2014.hanson-sustainability.co.uk/water-and-biodiversity/>

## Water recycling – Lafarge Tarmac

Lafarge Tarmac received an award from the Environment Agency for reducing its water use at one of its cement plants by using an innovative **water recycling** system deployed in a Special Area of Conservation.

Historically, the plant's water system was supplied with water abstracted from the nearby River Hamps. Between 2006 & 2008, a former shale quarry at the Works was developed into a source for recycled water and a biodiversity resource. By installing a water recycling system, the shale lake now forms the 'hub' of the site's gravity drainage system, with floating pumps installed to pump the water the Works needs for cooling.

The result has been to reduce Lafarge Tarmac's abstraction of water from the river by 100% with the works now being self sufficient in terms of water supply through the use of harvested rainwater. By changing to this new system, Lafarge Tarmac has also saved around £14,000 per year in electrical costs and has significantly reduced ongoing maintenance requirements by eliminating five pumps. This has also had a positive impact in reducing carbon emissions. The system has reduced the flood risk to property in a nearby village, and provided an attractive public amenity.

<http://www.lafargetarmac.com/media/492458/sustainability-case-study-cauldon.pdf>





## Is water availability a business risk for manufacturers?

The World Economic Forum's Global Risks 2014 Report lists water security as one of the top three global risks<sup>14</sup>. Immediately we tend to think of the world's arid and semi-arid places and the terrible droughts that impact on people, their livelihoods and ecosystems, but evidence is growing of water stress in parts of Europe and indeed in parts of the UK.

### Is water availability a problem in the UK?

In parts of the UK, water supplies are already under stress, with demand for water expected to increase with a growing population, urbanisation and changing lifestyles; a situation only exacerbated by increasing volatility of weather causing more frequent droughts and floods. The Environment Agency predicts that the plausible envelope of future water demand in the 2050s is from 28 per cent lower to 49 per cent higher than today<sup>15</sup>. Many water catchments in the UK are already thought to have no spare water that can be allocated for further abstraction.

### How relevant to construction product manufacturers?

Since water is vital to the manufacture of construction products in so many ways (see Chapter 2), and water resources in some areas of the UK are considered to be increasingly under pressure, then the question must be asked as to what extent water availability is likely to be a business risk for manufacturers in the short, medium and long terms and how aware are they of this risk.

### Are construction product manufacturers aware of potential business risks associated with water?

Evidence from a 2013 survey of construction product manufacturers<sup>16</sup> found that manufacturers are indeed becoming increasingly aware of the potential impact of variable supplies of suitable water and the risk this poses to their businesses. Business risks can manifest in two main ways – either through restriction of the quantity of water available (whether physical or regulatory related) or through declining water quality. The survey indicated that businesses characterise the risks associated with the availability of water supply in adequate quantities as potential and short term (3–5 years), whilst availability of water of suitable quality is perceived as a lesser risk at medium term (within 10 years).

Water risk is primarily a local issue and individual water catchments may be under differing pressure from changing rainfall patterns, abstractions and the need for a certain level of water and water quality to maintain the natural environment. For some catchments, the risk of water scarcity is already high. However, the local nature of the issue, as well as the diversity of uses and variety of opportunities for good water management in product manufacturing processes, makes the scale of the business risk difficult to estimate as it is different between different material sectors, individual manufacturers and manufacturing sites. Even those manufacturers who have already instigated programmes of measures to reduce overall water use may find themselves in the future at risk from abstraction reform and may need to take further steps in the future, some of which may entail significant costs, in order to sustain production.

The location of manufacturing production facilities in the UK is driven by many factors including raw material availability, cost and availability of land or labour, and proximity to markets. It is clear that the ability to manage available water resources to maintain production is likely to become an increasingly important additional driver. However, some manufacturers do not have the ability to re-locate existing, or locate new operations, based on factors such as water availability. One such example would be quarry operators, who provide the basic raw materials that underpin the wider construction sector - minerals can only be worked where they naturally occur. Re-locating the processing operations associated with aggregate production would significantly increase the environmental impact of such operations due to increases in vehicles movements, loss of efficiencies and complications with waste handling procedures.

---

<sup>14</sup> [http://www3.weforum.org/docs/WEF\\_GlobalRisks\\_Report\\_2014.pdf](http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2014.pdf)

<sup>15</sup> EA (2013) Current and future water availability – addendum A refresh of the Case for Change analysis [online] available at [http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/LIT\\_8951\\_b4d670.pdf](http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/LIT_8951_b4d670.pdf)

<sup>16</sup> CPA survey of members (2013)



## Mitigating risk of water stress

Risk mitigation options available to manufacturers in locations increasingly subject to challenging water availability are to:

- **Follow the water hierarchy** (page 9) to ensure maximum value from the water available
- **Water stewardship**; working with a wide array of stakeholders in a water catchment to manage water more efficiently by enabling the capture and storage of water during periods of increased availability to even out seasonal effects on availability

### Water Stewardship

Water stewardship is seen by many as the 'gold standard' in managing water supplies, taking the concept beyond a company's own operations. There are examples of water stewardship approaches to managing water scarcity from across the world, including the UK. The topic gained momentum initially within the food and drink sector, where large volumes of water are consumed for agriculture, and incorporated into product. The concept is that water management should be a stakeholder-inclusive process that involves both site and catchment based actions.

[http://www.panda.org/what\\_we\\_do/how\\_we\\_work/conservation/freshwater/water\\_management/](http://www.panda.org/what_we_do/how_we_work/conservation/freshwater/water_management/)

**The Ecosystem Markets Task Force**, a business led group, tasked by government to review the opportunities for UK business from expanding green goods, services, products, investment vehicles and markets which value and protect the natural environment, in its 2013 report has an entire section focused on water (<http://www.defra.gov.uk/ecosystem-markets/files/Ecosystem-Markets-Task-Force-Final-Report-.pdf>).

It recommends that there should be greater incentives for water catchment management which enables water companies, farmers and businesses to work together on a much larger scale to deliver benefits. It comments that an integrated review of the water cycle is enabling fresh thinking and new opportunities to manage water throughout the cycle. It notes that businesses are increasingly recognising the commercial advantages of managing their risks and dependencies of access to high quality water supplies.

## Incentives for businesses to become more water efficient

**Incentives** in the form of reduction of tax liability are available to businesses for the purchase and installation of new water-efficient equipment technologies.

### The Enhanced Capital Allowance (ECA) Scheme<sup>18</sup>

The scheme offers a 100% first-year allowance for investments in certain water efficient plant and machinery. The scheme is managed by Defra and HM Revenue & Customs (HMRC). Information can be found at <http://www.hmrc.gov.uk/capital-allowances/fya/water.htm>

Products which feature on the ECA Water Technology List (WTL) are eligible. Water efficiency technologies and products such as water efficient taps, toilets, monitoring equipment and industrial cleaning equipment are listed on the Water Technology List (WTL). Manufacturers of both water using products and water re-use systems can apply for them to be included on the List.

---

<sup>18</sup> <https://www.gov.uk/government/publications/water-efficient-enhanced-capital-allowances>

### 3. Construction products and water management in the built environment

Construction product manufacturers make the products that are used in the built environment to enable water to be managed more wisely. According to the Energy Savings Trust (2013), homes across Britain use 3288 billion litres of mains water each year<sup>18</sup>. An additional 1500 billion litres of mains water is used annually by public and commercial premises including our offices, schools, hospitals, hotels, shops and infrastructure, a significant proportion of this is for domestic type uses such as wc flushing, dish washing, showering in hotels and business, rather than water associated with an industrial process<sup>19</sup>.

Given the increasing concern over water availability then clearly finding ways to lessen this impact so as to reduce pressures on supplies and maintain healthy ecosystems and water quality whilst maintaining product performance is both crucial and the challenge.

Water use in buildings is regulated in England and Wales by Part G of the Building Regulations, which covers cold water supply, water efficiency, hot water supply and systems, sanitary conveniences and washing facilities, bathrooms, and kitchen and food preparation areas. In Scotland Standard 3.27 of the Building Standards Technical Handbook states the requirement that every building must be designed and constructed in such a way that sanitary facilities are installed with water efficient fittings designed to prevent the undue consumption of water. There are also numerous initiatives by both government and industry to improve consumers' awareness of the need to use water wisely and to provide guidance on easy behavioural changes and products that can deliver water savings. In addition, drainage from buildings is regulated by Part H of the Building Regulations in England and Wales, and by Standard 3.6<sup>20</sup> on surface water drainage and waste disposal in Scotland.

Recent flooding in parts of the UK have given attention to issues of soakaway and water runoff, and these topics come under a variety of regulations including in England and Wales the Flood and Water Management Act and the Flood Risk Regulations (for a comprehensive list of relevant regulations see Susdrain (<http://www.susdrain.org/delivering-suds/using-suds/legislation-and-regulation/england-and-wales.html>)).

Construction product manufacturers therefore play a vital role in developing and supplying the products that help others in the built environment manage water more efficiently – be it domestic households or commercial operators.

#### Types of construction products and their role in water management

Much innovation has gone into creating and developing products that improve the efficiency of water use, for instance showers that maintain the sense of water pressure but use far less water and innovative products to capture water or facilitate run off and soakaway.

Four broad groups of construction products facilitate better water management in the built environment, they are:

- a) Products that help reduce water use in buildings
- b) Products that enable building occupiers and infrastructure managers to recycle or use alternative sources of water
- c) Product systems that channel or soak up rainwater (runoff)
- d) Products that help other product manufacturers reduce water use in their processes

A summary of each product type with some examples of their use follows.

<sup>18</sup> EST (2013) At home with water [online] available at <http://www.energysavingtrust.org.uk/About-us/The-Foundation/At-Home-with-Water> combined with information on number of households in great Britain available at <http://www.ons.gov.uk/ons/rel/census/2011-census/key-statistics-and-quick-statistics-for-local-authorities-in-the-united-kingdom---part-3/rft-qs402uk.xls>

<sup>19</sup> WRAP (2011) Freshwater availability and use

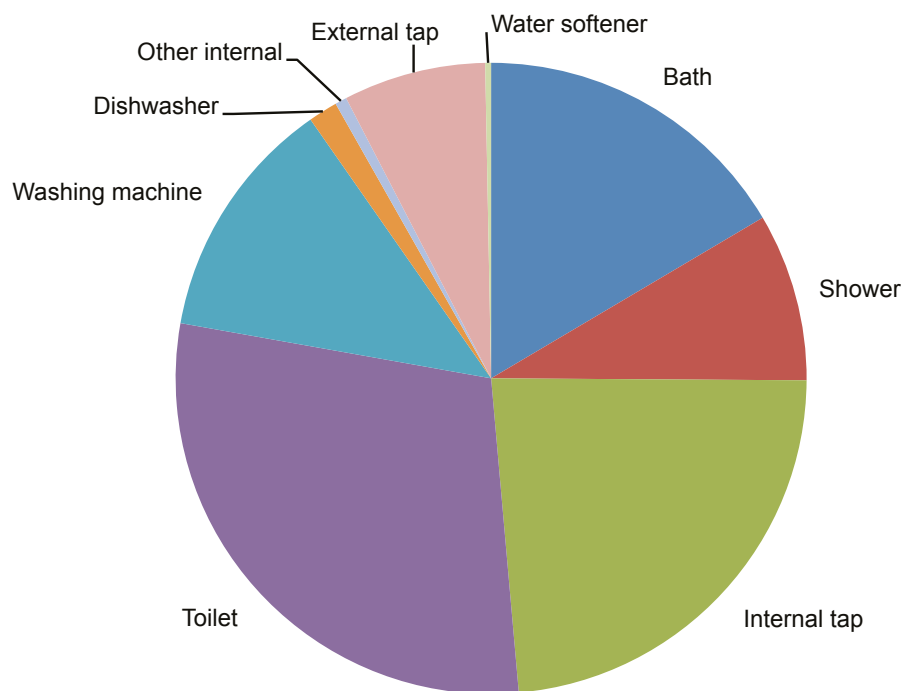
<sup>20</sup> [http://www.energysavingtrust.org.uk/domestic/content/saving-water?gclid=CN78o\\_vNz8lCFdTLtAodx0oAaA](http://www.energysavingtrust.org.uk/domestic/content/saving-water?gclid=CN78o_vNz8lCFdTLtAodx0oAaA)

## a) Products that help reduce water use in buildings

The Energy Savings Trust in 2013 published a review of domestic water use in Great Britain; the analysis was based on 86,000 households' self-reported water use information. It found that each person uses about 142 litres of water each day and the average home almost 350 litres daily. Showering has overtaken the use of baths as the favourite means of washing and is now the activity in homes which accounts for the largest total water use (25% or 840 billion litres). Toilets use around 740 billion litres a year in Britain which is 22% of the total<sup>21</sup>.

A great many households are now engaging in water savings behaviour and this is assisted by innovation and new developments in the products industry.

Figure 7. Breakdown of water use in new homes derived from high resolution monitoring at a sample of 70 properties (WRc, 2008<sup>22</sup>)



### Sanitaryware and sanitary tapware

Manufacturers have developed products that enable both householders and businesses to minimise their water usage from domestic activities such as toilet or urinal flushing, hand washing and showering.

#### • Efficient taps

Water-efficient taps either reduce water flow rate through the tap or they assist the user to avoid 'wasting water by automatically turning off after a preset time (push taps), or by stopping automatically when the use ends (e.g. using infrared sensors).

21 EST (2013) At home with water [online] available at <http://www.energysavingtrust.org.uk/About-us/The-Foundation/At-Home-with-Water> combined with information on number of households in great Britain available at <http://www.ons.gov.uk/ons/rel/census/2011-census/key-statistics-and-quick-statistics-for-local-authorities-in-the-united-kingdom---part-3/rft-qs402uk.xls>

22 WRc (2008) CP337 Water use in new dwellings. Report P7694

## • Efficient baths and showers

Personal bathing accounts for much of the water use within homes, hotels and other residences. Cleverly designed baths and showers allow the user to have the same experience – a luxury bath or perhaps an invigorating shower – without using excess water. Lower capacity baths are achieved by varying the location of the overflow, and by ergonomically shaping them to match our bodies. The feel of a powerful spray from a shower is achieved through a variety of technologies including aerating shower droplets, novel spray patterns, and pulse-plate technology.

The Bathroom Manufacturers Association (BMA) is the trade association for bathroom manufacturers trading in the UK and gives guidance on ways for the consumer to be more water efficient.

The BMA has produced a Top Twenty Tips for saving water in the bathroom.  
<http://www.bathroom-association.org/education/water-hog/>

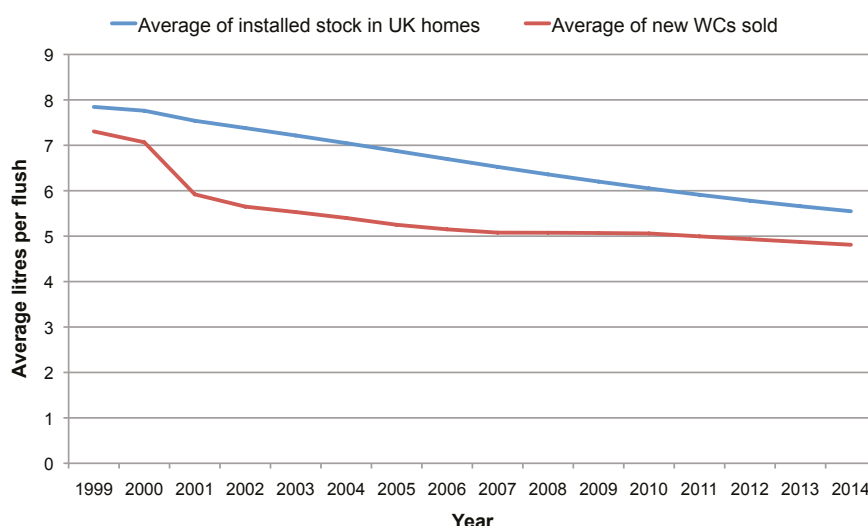
## • Efficient toilets

Modern toilets use less water than their predecessors. Since 2001 the Water Supply (Water Fitting) Regulations have required that all toilets installed have a nominal flush volume less than 6 litres – this is compared to some old products which flush in excess of 14 litres of water when used (see figure 8).

Innovations readily available on the market today to reduce the amount of water needed for flushing include better designed pans, dual flush cisterns and infra red controlled flushes to prevent multiple flushes. The lowest flush rate with conventional technology is 4 litre per full flush (2.6 litre per part flush). A flush volume as low as 1.5 litres of water is available on the market but can only achieve this by forcing the water through with a jet of air.

Urinal controls are also key to managing water use. Early urinals tended to flush automatically at a regular interval, whereas the latest technologies allow urinals to be flushed only when used and only when buildings are occupied. In addition, flush-free urinals so called waterless urinals, may be appropriate in some circumstances– though they still need water for cleaning.

Figure 8. Interpretation from Market Transformation Programme (MTP) (2011) WCs: market projects and product details V1.0



The uptake of these technical innovations by householders is encouraged and supported by information and guidance provided by industry working with others. The European Water Label, the Water Energy Calculator and the Bathroom Manufacturers Association's Water Saving Tips are examples, explored in more depth in Annexe 3.

## Figure 9. Innovation for water efficiency in showers

The main requirements of users for a satisfying shower are temperature stability, adequate water volume and distribution, and perceived skin pressure (MTP 2006)<sup>23</sup>. Traditionally, these requirements are met through provision of a high flow rate of water through the shower head. However, such practices have resulted in a rise in the volume of water used in homes for showering as the popularity of showers in the UK has overtaken baths as a means of personal washing.

Research over the last ten years has therefore focussed on how these parameters of satisfaction can be achieved in more innovative ways.

Two technologies that have been developed are the aerating shower heads, and the 'pulse plate' shower head.

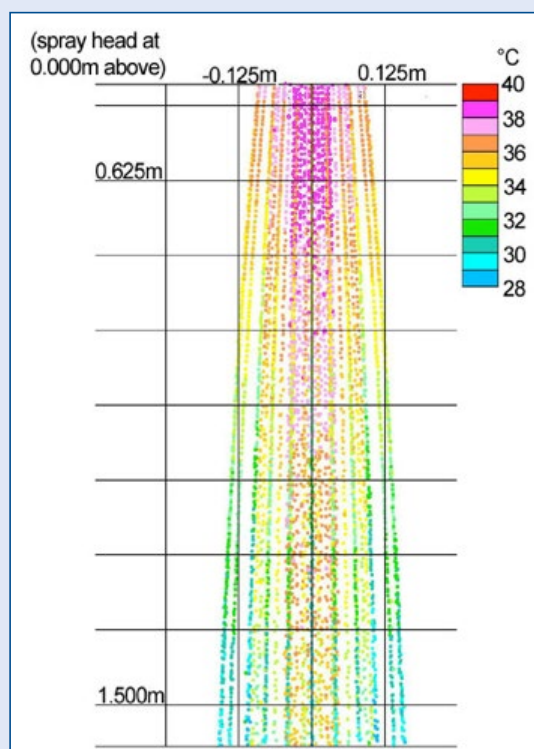
Aerating shower heads entrain air within the droplet, creating a bigger droplet without the need for a higher volume of water. The resultant impact on the skin feels like a larger droplet and therefore should provide more user satisfaction.

BUT Many aerating shower heads need an operating pressure of 1.5 bar and while they may reduce flow in the high pressure range, there are many 'normal' products that have optimised flow rates that work on both high and low pressure supplies that may in fact deliver lower flow rates than aerating shower heads.

Another technology available (though difficult to find) is the pulseplate shower<sup>24</sup> which works by deflecting droplets backwards into an expansion chamber. This action causes pressure to build and when it reaches a certain level, the water bounces back out of the chamber. The resulting pulsation occurs between 30 and 40 times per second and manipulates the surface tension of the water to ensure that the pressure is as high as possible in every single drop.

Businesses can also benefit from these technologies as many provide showering facilities for staff.

Figure 9a. The spray pattern and droplet size affect the temperature stability and skin pressure of the shower – and hence whether or not the user believes the shower is satisfying or not. Image taken from MTP (2006)<sup>23</sup>



23 UK Government Market Transformation Programme (2006) The physics of showering Report BCD2AEA697

24 <http://www.pulseecoshower.co.uk/FAQs.aspx>

## **b) Products that enable building occupiers and infrastructure managers to recycle water or use alternative sources**

In the most recent review of the Building Regulations (Approved Document G 2010) for England and Wales, Requirement G1 was amended to allow the provision of water of a suitable quality to sanitary conveniences fitted with a flushing device. Whilst detailed guidance was not provided and “suitable quality” has not yet been defined (though British Standards are being developed), for the first time harvested rainwater and reclaimed greywater are permitted as sources of water for specified uses in both domestic and commercial buildings.

The British Standards Institution (BSI) convenes a Committee (CB/506) responsible for developing standards on water reuse (including rainwater and greywater harvesting). Standards BS 8525 (greywater systems) and 8515 (rainwater harvesting) cover expected water quality from the output of these systems.

### **• Greywater recycling systems**

In the domestic context, greywater systems collect the water from sources such as baths, showers and hand basins and reuse the collected water for toilet flushing, washing machines, and external use. Water reuse systems are also widely used in industrial applications. The applications for which the reused water can be used depend on the level of treatment carried out within the greywater system.

### **• Rainwater harvesting goods**

The concept of rainwater harvesting is neither complicated nor modern (the Nabateans were doing it in Petra 2000 years ago)<sup>25</sup>. Systems can vary from the small and basic, such as the attachment of a water butt to a rainwater downpipe, to the large and complex, such as those that collect water from large areas and serve significant numbers of properties. For domestic purposes rainwater harvesting systems are applicable to both domestic and commercial properties, with the collected water primarily used for toilet flushing, garden irrigation and, less frequently, washing machines.

The UK-Rainwater Harvesting Association (UK-RHA) is the trade association for the manufacturers, suppliers and installers of rainwater harvesting systems for the UK market. The Association also represents the interests of its members in relation to other forms of water re-use, and surface water management (SuDS).

<http://www.ukrha.org/>

---

<sup>25</sup> <http://www.nabataea.net/water.html>

### c) Product systems that channel or soak up rainwater (runoff)

Sustainable Drainage Systems (SuDS) is the term used to describe an approach to managing rainwater falling on roofs and other surfaces that harnesses or mimics natural environmental processes. The key objectives are to manage the flow rate and volume of surface runoff to reduce the risk of flooding and water pollution. To achieve this, elements of the built environment that receive and handle rainwater are designed so that initial flows can be attenuated, runoff water channelled or stored and surface water transported at a controlled rate. SuDS also reduce pressure on the sewerage network and can offer scope for biodiversity and local amenity.

#### Susdrain

Many of those involved with Sustainable Drainage activities have formed Susdrain, an independent platform, created by CIRIA, for those involved in delivering sustainable drainage. [www.susdrain.org](http://www.susdrain.org) provides up-to-date guidance, information, case studies, videos, photos and discussion forums that help to underpin the planning, design, approval, construction and maintenance of SuDS.

Susdrain lists five key principles underpinning SuDS which enable the design and planning process to mimic natural drainage.

- Storing rainwater and releasing it slowly (attenuation)
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

Manufacturers have developed products that enable these principles to be implemented, for example:

- **Pervious surfaces**, which allow rainwater to infiltrate through the surface to underlying ground. In this way surface runoff is prevented from reaching rivers, streams, lakes or combined sewers, and peak flows are attenuated. Pervious surfaces are often installed in areas of vehicle or pedestrian traffic, such as car parks. Clay and concrete product manufacturers have developed permeable paving products which allow water to infiltrate through them.
- **Storage and soakaway installations**, in which storage units with a high void ratio i.e. empty space (typically 95%) are installed below ground to create a structure for the temporary storage of surface water prior to infiltration, controlled release (attenuation) or re-use (rainwater harvesting). Individual units are typically plastic modules which can be combined to give the required volume, and used in conjunction with permeable or impermeable membranes to allow slow release or storage of water. Such installations may be installed beneath pervious surfaces or as part of a green roof, and they may be integrated into a rainwater harvesting system.
- **Green roofs** are designed to intercept and retain precipitation, reducing the volume of runoff and attenuating peak flows<sup>26</sup>. A green roof typically comprises a number of layers, including an impermeable layer, a substrate or growing medium and sometimes a drainage layer. Green roofs store rainwater in the plants and substrate and release water back into the atmosphere through evapotranspiration<sup>27</sup>.

The combination of different elements within an overall SuDS system is important and brings further benefits; for example the retention of water at roof level allows smaller pipework to be used to channel rainwater when it does leave the roof.

<sup>26</sup> Green roofs have become more popular in recent years and the sector has established a trade association to ensure quality and standards (<http://www.livingroofs.org>) as well as a National Centre of Excellence (<http://www.thegreenroofcentre.co.uk>), which has the aim of promoting green roof development and implementation through research, education, demonstration, information and technology transfer.

<sup>27</sup> [http://www.thegreenroofcentre.co.uk/green\\_roofs/benefits\\_of\\_green\\_roofs](http://www.thegreenroofcentre.co.uk/green_roofs/benefits_of_green_roofs)



## Geocellular modular systems

Geocellular storage systems are modular plastic units with a high void ratio (typically 95%) that can be installed to create a below ground structure for the temporary storage of surface water prior to infiltration, controlled release (attenuation) or re-use (rainwater harvesting).

The storage structure (tank) is formed by stacking up the required number of individual units and wrapping them in either a geotextile (infiltration) or geomembrane (storage).

The modular nature of geocellular systems gives designers flexibility to design structures tailored to suit the specific characteristics and requirements of the site.

The structures can be used for deep box structures or for shallow applications as part of a source control drainage system.

Some modular systems incorporate treatment components to provide both quantity and quality control.



## Didcot Parkway station

Completed in Spring 2014, Didcot Parkway Station in Oxfordshire provides an efficient interchange for public and private transport, ensuring it has the capacity to meet future travel demand as the number of people living and working in the area increases.

The £6.7m redevelopment centred on resolving the station's poor layout, traffic congestion and its vulnerability to flooding.

To tackle the flooding issue, main contractor Balfour Beatty installed a sustainable surface water management scheme (developed by Jacobs Engineering Group) that utilises space beneath two of the station's three new car parks to accommodate ACO StormBrixx attenuation tanks with sufficient capacity to hold and safely discharge run-off from across the redesigned pedestrian piazza and forecourt.

Run-off discharge rates from both catchments are controlled using two ACO Q-Brake vortex flow control units. The discharge from the tank first passes through an oil separator before being released into the watercourse. This discharge is limited to a maximum of 10 litres/second to ensure that the development has no detrimental impact on the local environment.



#### **d) Products that enable other manufacturers and construction contractors to reduce water use in their processes**

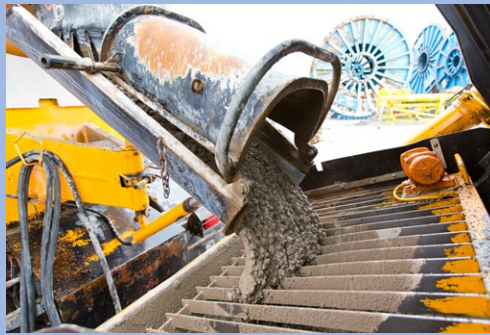
These tend to be of a chemical nature and either alter a manufacturing process so that less water is required or else may be coatings that prevent the leakage of water.

For example, BASF produce a product that enables cement producers to use less water in their mix, especially useful if concrete needs to be poured quickly on major projects such as the Shard, thereby reducing the amount of water used.

##### **Water reduction in the Concrete industry - BASF**

BASF's new generation of MasterGlenium superplasticizers allow concrete producers to significantly reduce (by up to 40%) the amount of water required to achieve a given consistency in fresh concrete whilst increasing strength, improving durability and reducing permeability. The product was used in construction of the Shard basement and for the Forth Replacement Bridge in Scotland; both projects required a large and fast concrete pour.

The water savings can be further enhanced with the MasterSet DELVO waste water management system which significantly reduces the production of contaminated waste wash-out water at a concrete production plant.



##### **Reducing water use through product innovation – Wienerberger Ltd**

Wienerberger is delivering water savings to its supply chain with the innovative Porothersm system. Porothersm is a clay block walling system which utilises thin-joint mortar to bond the blocks together. The specially designed mortar requires up to 95% less water compared to traditional mortar. With no mortar needed in vertical joints and a minimal 1mm thick bed joint, Porothersm walls are quick to assemble and provide maximum build volume for minimum water and material usage. In addition, Porothersm contains up to 30% MARSS (recycled) materials and has an A+ BRE Green Guide rating.

By using the Porothersm system construction sites can have less impact on the local water supply and minimise material wastage. Wienerberger, by combining water efficient manufacturing processes with product innovation, aim to deliver sustainability solutions that extend beyond the factory gate.

## 4. Water use, energy and carbon

The pumping, treating and heating of water all require energy and thus, depending on the source of energy, may have associated implications for emissions of carbon dioxide and other greenhouse gases (GHG).

### The link between water, energy and carbon

The different sources of water; uses and consumption of water and methods of disposal of water equate to different carbon emissions associated with the water use for any business including construction product manufacturing. At a given site, pumping, treating and heating water will add to the carbon load associated with water use and will be site specific.

Water and energy are linked in the following ways:

- Any mains water supplied will have been **treated and pumped** before it reaches the point of use, whether that is to a manufacturing facility, construction site or occupied building; both processes require energy.
- Water directly abstracted from surface or groundwater sources, dewatering and water collected in storage tanks or lagoons all involve **pumping** to move the water to the place where it will be treated or used. The amount of energy required depends on the site characteristics, pump efficiency and the flow rate of water required.
- **Treating** water on-site uses energy. Treatment types may include settlement filters and/or aerated biological processes (though if it is a gravity fed settlement lagoon it will not need any energy until pumping). Energy is used for pumping of the wastewater between treatment stages and for aeration where required. Even though the energy use for settlement will be small, there is still consumption for rotating bridges, scrapers and recirculation of wastewater. For some manufacturers the quality of water required may be very specific, for others lower quality water may be used without damaging the production process or end product. For instance, water that is used within finishing products, or for ready-mixed concrete, must be of a suitable, and specified, quality, however the quality of water needed for washing aggregates could be lower.
- **Heating** water requires energy. The amount of energy required depends on the temperature of the ambient water and the temperature to which it is being heated. The efficiency of the boiler used will impact on the total energy requirement and, hence, associated carbon emissions.

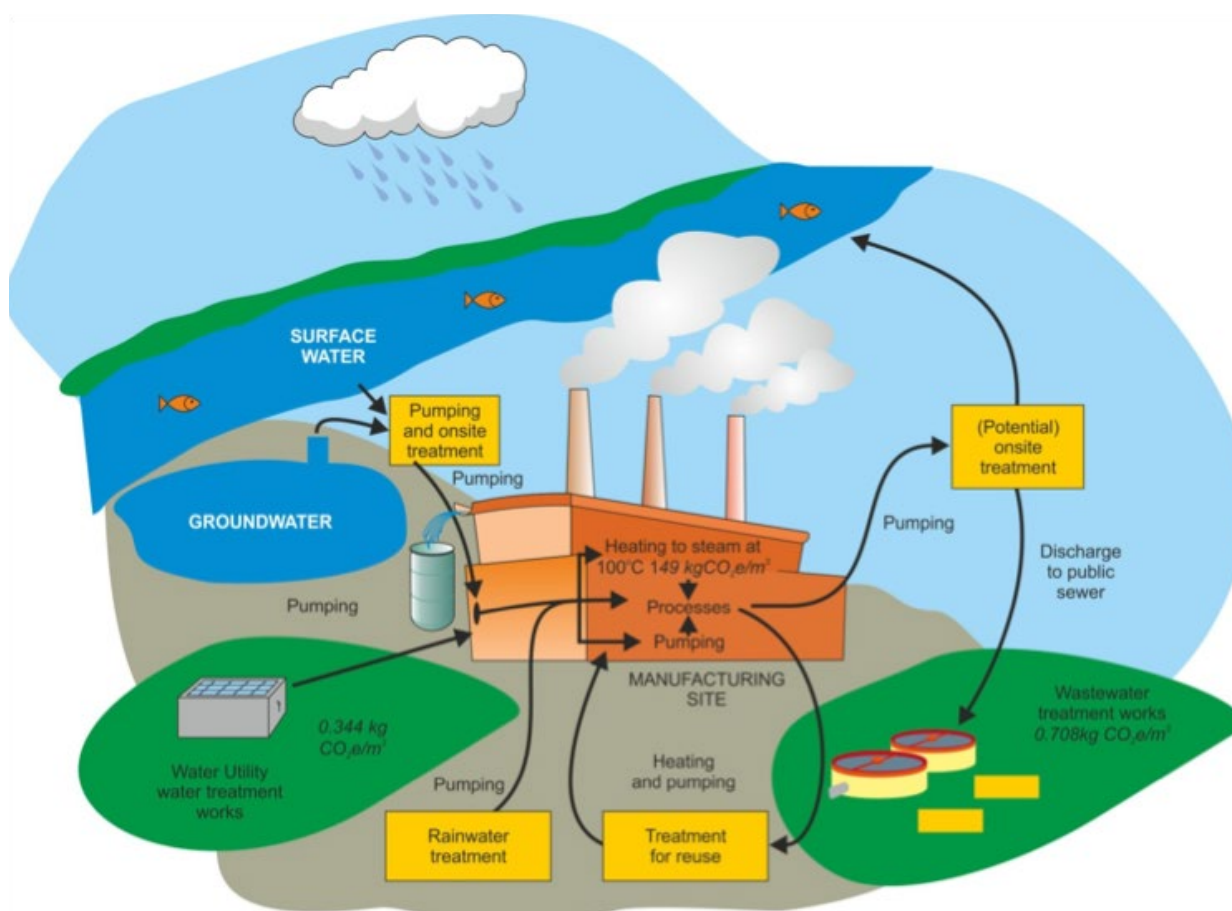
A good, structured water management strategy and an associated action plan are the key to reducing the carbon intensity of water use. Matching the quality of supplied water with the water quality needs of processes and activities minimises the energy and carbon intensity of water use across a facility. In operations where there are different water uses with different quality requirements, re-using water many times in a cascade of reducing quality minimises the energy and carbon burden of heating and treating it. The location of water harvesting systems may also help to reduce the need for, or amount of, pumping.

Using low-carbon technologies for treating waste water reduces the carbon intensity of this final stage in the chain of water use at a manufacturing site.

Different options for supply and re-use of water in a manufacturing context are explored in Figure 11 where key contributions to the energy and greenhouse gas (GHG) emissions associated with these processes are illustrated. The diagram presents an example of the use of water as steam. The quality of water required for the use will influence the need for treatment, whilst the characteristics of the water (e.g. temperature) may drive efficiency in recycling the water.

Domestic reuse of water was estimated in 2009 by the Environment Agency to be equivalent to 0.6 kWh/m<sup>3</sup> or 0.34 kgCO<sub>2</sub>e/m<sup>3</sup> where no treatment was required, whilst requirement for treatment may multiply this estimation by two or five. The 2013 DEFRA GHG conversion factors contain information on water supply and treatment <http://www.ukconversionfactorscarbonsmart.co.uk/>.

Figure 11. Relationship between water, energy and carbon from different sources



## The water/energy balance in manufacturing

As described in Chapter 2, manufacturing facilities have diverse uses for water with differing water quality requirements. Manufacturers have more flexibility than some others in the construction life cycle to implement a variety of water use/ sourcing and re-use strategies - some of which have been illustrated elsewhere in this publication. Identifying the optimum strategy involves balancing a number of considerations in a site specific assessment. The carbon implications of different water use and re-use strategies are one such consideration. Figure 12 highlights the carbon implications of some aspects of water use including those that are considered for alternative sources and recycling or reuse of water:

**Figure 12. Carbon Implication of Water Use**

	Origin of Water		
Aspects of Use	Mains Supply	Rainwater Harvesting	Recycled Process Water
Storage and supply infrastructure	Owned by utility to site boundary, on-site buffer storage tanks have embodied emissions	Rainwater collection tank (often made of plastics); Pump; Treatment unit	Water holding tank if storage required (often made of plastics); Pump; Treatment unit, if use requires treatment
Supply to site	Abstraction, treatment and pumping of the water to site. < 1 kWh/m <sup>3</sup> 0.34 kgCO <sub>2</sub> e/m <sup>3</sup> (Water UK 2010 <sup>28</sup> )	Pumping of the water from holding tank to the point of use. Varies from site to site, quoted values 1 - 1.5 kWh/m <sup>3</sup>	Pumping of the water from holding tank to the point of use will vary from site to site
Preparation of the water for use	Chemical treatment usually required for boiler / cooling system use, or for high-purity applications (e.g. rinsing electronic components)	Typically higher solids level than mains water; additional treatment may be required to bring it to the required quality (potential extra use of energy and/or chemicals)	Further treatment may be required to bring it to the required quality; usually overall operational energy and emissions equivalent to 1.5 to 3.5 kWh/m <sup>3</sup> . (EA 2010 <sup>29</sup> )
Preparation for use - heating	Temperature of the water is likely to be low, e.g. 10°C. Theoretical energy requirement to heat water to steam at 100°C is 732 kWh/m <sup>3</sup> , equivalent to 149 kgCO <sub>2</sub> e/m <sup>3</sup> using natural gas Pre-heating with waste heat in condensate, used water or boiler flue gases reduces energy requirement, while heating with renewable energy reduces carbon intensity		Heating requirement may be reduced when compared to fresh supply; however requiring > 1 kWh/m <sup>3</sup> for each degree to be gained. Heat in recycled hot or warm water can be recovered
Preparation for use - cooling	Water used in cooling systems may require chilling; refrigeration requires energy and some chillers still use refrigerants that are greenhouse gases. Optimising cooling systems, e.g. using air cooling where possible, offers significant energy savings		Recycled water unlikely to be lower temperature than incoming supply, so less useful for cooling applications where chilled water is required
Treatment after use in process	Effluent discharged to public sewer is treated in a wastewater treatment works, with carbon emissions approx. 0.71 kgCO <sub>2</sub> e/m <sup>3</sup> . On-site treatment may be required, requiring energy and possibly chemical inputs. Effluent may be discharged to rivers, requiring pumping. On-site treatment will almost always be required. Lower contamination levels required than for discharge to sewer, so treatment usually more intensive. Recycled water to be stored may require treatment prior to storage. Reedbeds and lagoons provide low-carbon treatment options where they are feasible		

28 Water UK (2010) Sustainability Indicators 2009/10. [Online]:

<http://www.water.org.uk/home/news/press-releases/sustainability-indicators-09-10/sustainability-2010-final.pdf>

29 Environment Agency (2010) Energy and Carbon Implications of Rainwater Harvesting and Greywater Recycling. Report SC090018. [Online]:

<http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/scho0610bsmq-e-e.pdf>

## 5. Measuring water and assessing environmental impacts

Water reporting, in parallel with carbon reporting, is beginning to emerge as a headline indicator on a corporate and a product level. This is in response to increasing awareness of the pressures on water resources across the globe, especially in relation to water scarcity.

The water associated with every stage of the construction life cycle can be measured and reported as either a volume or a flow rate and in many instances is a relatively straightforward measurement. Such information can inform management and investment decisions if water is deemed a significant cost or its availability is deemed a potential business risk. Effective water reporting can thus help drive performance improvements and innovation on the multiple levels of strategic, corporate and product business opportunities.

Measuring water quantities is one thing, but understanding and measuring the environmental impact of water consumption is a much more complex process and a variety of different terms have come to be used for the measurement of water consumption associated with a product, building or project. These terms have tended to become intertwined and somewhat confused. The most common terms encountered are water footprinting, water calculator and embodied water. Also, as is inevitable in a rapidly developing topic, these terms often mean different things to different groups of people and are sometimes used interchangeably. However, accepted definitions of key terms are beginning to emerge (see definitions in Figure 13). This chapter discusses these terms and the various initiatives addressing this complex topic.<sup>30</sup>

### Figure 13. Definitions & Concepts

Any discussion about water measurement and reporting utilises many terms which can mean different things to different people. Definitions used in this publication are listed below. Where possible, these are based on definitions provided in the water footprinting standard (BS ISO 14046:2014 Environmental management - Water footprint - Principles, requirements and guidelines<sup>31</sup>).

#### Water Availability

The extent to which humans and ecosystems have sufficient water resources for their needs. Water quality can also influence availability, e.g. if quality is not sufficient to meet users needs. (Water comprises 73% of the Earth's surface, but humans, terrestrial animals and plants cannot survive on untreated seawater or groundwater with very high salt levels.)

#### Water Use

Use of water by human activity. Use includes any water withdrawal, water release or other human activities within the drainage basin impacting water flows and/or quality, including in-stream or in situ uses such as fishing, recreation, transportation.

#### Consumptive use of water

Water consumption is often used to describe water removed from, but not returned to the same drainage basin. Water consumption can be because of evaporation, transpiration, integration into a product, or release into a different drainage basin or the sea. Thus water extracted from a river for cooling and returned to the same river is used but not consumed, while water extracted from a river and incorporated into a product is both used and consumed.

#### Water Scarcity

Extent to which demand for water compares to the replenishment of water in an area, e.g. a drainage basin, without taking into account the water quality.

#### Water Quality

Physical (e.g. thermal), chemical and biological characteristics of water with respect to its suitability for an intended use by humans or ecosystems.

#### Drainage Basin

Area from which direct surface runoff from precipitation drains by gravity into a stream or other water body. The terms "watershed", "drainage area", "catchment", "catchment area" or "river basin" are sometimes used for the concept of "drainage basin".

30 <http://shop.bsigroup.com/ProductDetail/?pid=000000000030250082>



## Measuring and reporting water associated with construction product manufacturing

Manufacturers in the UK measure water at various stages in production and for a variety of reasons:

- Measurement of **mains water** is almost universal as bills have to be paid to the appropriate water company. Mains water accounts for the biggest proportion of water used by construction product manufacturers (CPA Survey, 2013).
- Measurement of water directly **abstracted** from surface water (e.g. rivers) and ground water (e.g. boreholes) is usually covered by an abstraction license which requires the manufacturer to record and report water use to the relevant regulator such as the Environment Agency or Scottish Environmental Protection Agency. (The majority of abstracted water is used for mains water and by the electricity industry for cooling and hydropower).
- **Discharge** of water from a site is usually covered by regulatory requirements which require recording and reporting to the relevant regulator as above.
- Factories with **environmental permits** (which can cover water discharge, waste management and emissions to air<sup>31</sup>) typically have to record and report data along with some performance metrics such as water use per unit of product to the relevant regulator (most often the Environment Agency or local government)
- A breakdown of total water use and consumption by water **source** can be valuable information for manufacturers - to feed into cost calculations or risk assessment
- Those manufacturers producing **water-related products** such as showers, taps or baths have a particular interest in being able to measure and report how their products can affect their customer's use of water. This information can be an important part of the marketing process
- Manufacturers may use Life Cycle Assessment (LCA) methodology to produce an **Environmental Product Declaration** (EPD) to provide information for designers, specifiers and contractors on the water resources consumed in producing their products – known as “embodied water”. This is measured as net use of freshwater in cubic metres (m<sup>3</sup>). See the next section for a detailed discussion of embodied water.

## Embodied water of construction products

**The concept.** The construction industry first developed the concept of embodied energy to distinguish the energy associated with construction materials – energy used in their extraction, manufacture, transport, installation, maintenance and disposal - from the energy associated with operating buildings known as “operational energy”. As climate change became a concern, industry moved to the measurement of embodied carbon and operational carbon and as interest has grown in water, the term “embodied water” has come to be used in relation to the water associated with construction materials.

**Environmental Product Declaration Schemes.** Some measure of embodied water has been included as an indicator within most Environmental Product Declarations (EPD) schemes for construction products since the 1990s. For instance, in the UK, it has been reported in the Building Research Establishment (BRE) Environmental Profiles<sup>32</sup> since 1999, in the French Experimental Standard XP P01-010 since 2001<sup>33</sup> and in the German IBU EPD scheme<sup>34</sup> since 2004. This “embodied water” refers to the cumulative quantity of freshwater consumed in making a product and is measured in m<sup>3</sup>.

---

31 <http://www.legislation.gov.uk/ukdsi/2013/9780111532126/contents>

32 <http://www.bre.co.uk/greenguide/page.jsp?id=210>

33 AFNOR, 2001, Methodology and model of data declaration, experimental standard XP P01-010-1

34 <http://construction-environment.com/hp481/Environmental-Product-Declarations-EPD.htm>

For a detailed explanation of the means of assessing the embodied impacts of construction products see Anderson and Thornback (2012), *A Guide to Understanding the Embodied Impacts of Construction Products*<sup>35</sup>.

**Consumptive use and non-consumptive use.** Originally, the concept of embodied water as proposed by Allan in 1993<sup>36</sup>, referred to the cumulative quantity of water used to produce a product through the supply chain i.e. the total water entering the product system. However, over time, as the difference between “use” and “consumption” has come to be better understood, the latter concept of “water consumption” has become the basis of the water indicator used in most of the EPD schemes for construction products. The definitions are as follows.

Consumptive Use	Non-Consumptive Use
<p><i>“Uses or activities where water is not returned to the immediate environment from whence it came because it is evaporated, transpired, incorporated into products or consumed by humans or livestock.”</i></p> <p>For example, water use in welfare facilities is usually regarded as consumptive as it is discharged via the sewer.</p>	<p><i>“Uses or activities where water is returned to the source from which it was drawn.”</i></p> <p>For example, non-evaporative cooling is very often non-consumptive as water is discharged to the environment, close to the original abstraction point, without a significant change in water quality.</p>

Understanding this difference between consumptive use and non-consumptive use is important and has repercussions on the way that impacts associated with water are measured. This new thinking about water resulted in changes to the way that EPD schemes measured water; for instance freshwater consumption was adopted in the 2007 revision of the BRE's Green Guide and Environmental Profiles Methodology. See Annexe 2 for details of inclusion of a water indicator in different European and global environmental profiling schemes for construction products.

**Harmonization of EPD schemes across Europe.** The existence of the different nationally based (but not necessarily government owned) EPD schemes for construction products across Europe prompted the European Commission in 2004, in the interests of ensuring there were no barriers to trade within the single European market for construction products, to mandate for the development of a European standard for the production of Environmental Product Declarations (EPD). The resulting standard, published in 2012, is called *EN 15804<sup>37</sup> Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products*. As with the BRE and other European schemes the water indicator in EN 15804 measures the net use of freshwater in cubic metres (m<sup>3</sup>).

**The importance of Consistency.** This standard methodology is important because the cumulative water indicator in EN 15804 compliant Environmental Product Declarations enables the net freshwater use associated with an assembled building or structure to be compiled in a consistent way. This consistency is crucial otherwise meaningful comparisons cannot be made. Clients, specifiers, designers and contractors are becoming interested in metrics that indicate total water consumption within the supply chain and throughout all stages of the construction life cycle, and/or the combined impact of all those individual uses (sometimes called Whole Life Water). For a building this requires that the water embodied within the construction products be added to the water consumed during the construction process, plus the water consumed during the operational life of the building (“operational water”) and water consumed at end of life during demolition. To carry out this cradle to grave analysis requires standardised definitions and common reporting formats to allow the collation and combination of “consumption” information from the different points in the supply chain in a meaningful way. This standardisation is a key issue and the publication and adoption of EN 15804 is a major step in that journey.

35 <http://www.constructionproducts.org.uk/publications/technical/display/view/a-guide-to-understanding-the-embodied-impacts-of-construction/>

36 Allan, J.A., 1993. Fortunately there are substitutes for water otherwise our hydropolitical futures would be impossible. ODA, Priorities for Water Resources Allocation and Management. ODA, London, pp. 13–26.

37 <http://shop.bsigroup.com/ProductDetail/?pid=00000000030279721>



**ECO Platform.** However, despite the European standardised methodology for EPD, there remain differences between the various European EPD schemes particularly in regard to scope and system boundaries. Therefore, it should be recognised that direct comparisons even based on EN 15804 compliant EPD should be treated with some caution. However, as a consequence, within Europe, there is now a process (a voluntary process) whereby the various EPD schemes are collaborating with the aim of aligning more closely their detailed methodologies to follow this new European Standard (EN 15804). This process is brought together under a body called the ECO Platform<sup>38</sup>.

**Data Availability.** To facilitate an adequate and robust accounting of water use and consumption in the construction sector requires data and only a few databases are currently available or accessible. The GaBi<sup>39</sup> and ecoinvent<sup>40</sup> life cycle databases, for instance, both provide data on water use and consumption in the production of a multitude of input materials and energy processes used in the construction materials sector; and for many construction products themselves. These data differentiate various water resource types including among others lake, river, ground, sea and rain water and can be used to derive water consumption data for generic products.

**Water Scarcity.** Despite the progress, an aggregated measure of total freshwater consumed (i.e. embodied water quantified in m<sup>3</sup>) is increasingly seen as only part of the story of understanding the impact of construction product manufacturing on water resources. Materials and products, including those for construction, can be sourced from many different geographical regions and in the case of timber for instance, consume water over long time periods. Given that water resources across the globe are under differing pressures, then the impacts of water use can have very different implications depending on where and how water is used (a litre of water running through a hydro power turbine in Wales has very different impacts compared to a litre of water used for irrigation in Sudan). Debate is therefore rife as to whether any methodology provides a truly meaningful indicator for environmental assessments and profiles.

## Water footprinting

The parallel discussion to that of the water indicator in Environmental Product Declarations for construction products is that of water footprinting. This relates to all products, for instance food crops such as vegetables grown in Africa and flown to European supermarkets or textile production for the global clothing industry. Water footprinting is the study of the water associated with organisations as well as products and has developed in two distinct phases.

- The first phase, led by the **Water Footprinting Network (WFN)**, resulted in the Water Footprint Assessment Manual<sup>41</sup>, published in 2011. This describes the classification of different water types (including water consumption) on an accounting level, i.e. inventory level.

WFN defines its Water Footprint as the total volume of fresh water that is used directly or indirectly to produce the product. It is calculated by considering water consumption and pollution in all steps of the production chain. The water footprint of a product breaks down into three components:

- Green water (rainwater use)
- Blue water (surface and groundwater use)
- Grey water (expressed as the theoretical dilution volume with which polluted water should be diluted to reach regulatory emission limits)

Water scarcity can then be determined by comparing the blue water footprint in a drainage basin or region with the corresponding blue water availability.

---

38 <http://www.eco-platform.org/>

39 [gabi-software.com/databases/](http://gabi-software.com/databases/)

40 <http://www.ecoinvent.org/>

41 Arjen Y. Hoekstra, Ashok K. Chapagain, Maite M. Aldaya and Mesfin M. Mekonnen. The water footprint assessment manual: setting the global standard, Earthscan, London 2011.

- The second phase has been led by **ISO, the International Standards Organisation**, building on the ISO 14000 family of life cycle standards. ISO published in 2014 an International Standard on Water Footprinting (BS ISO 14046:2014 Environmental management - Water footprint — Principles, requirements and guidelines<sup>42</sup>). This specifies requirements and guidelines to assess and report the water footprints of products and processes as well as organisations. In contrast to the WFN water footprint methodology, the ISO Standard goes beyond determining the water inventory by also evaluating the environmental relevance of each water inventory flow as part of the water footprint profile.

The ongoing work by ISO on water footprinting<sup>43</sup> has proposed various types of water footprints:

- **Water availability footprint** – a measure of water consumption taking into account the underlying scarcity and quality of the water consumed
- **Water scarcity footprint** – a measure of water consumption taking into account the underlying scarcity of the water consumed
- **Water footprint profile** – compilation of impact category indicator results (for example water availability, eutrophication, toxicity etc.) addressing potential environmental impacts related to water. If the Profile does not address all relevant attributes and aspects relating to the natural environment, human health and resources, then the term, “non-comprehensive water footprint” profile must be used
- **Weighted water footprint** – a single score indicator derived from the indicators within a Water Footprint Profile. A weighted Water Footprint cannot be used for comparative assertions
- **Water footprint** (according to BS ISO 14046:2014) – metric(s) that quantifies the potential environmental impacts related to water.

It is not yet clear which of the different kinds of water footprint proposed in the International Water Footprinting standard (ISO 14046:2014) will be the most useful to decision-makers or become the common basis for comparisons between different products for particular applications. Nor is there any indication yet of how these developments will be taken up in the future by key construction sector standardisation bodies, such as the European CEN/TC 350, though TC350 has started in 2014 a work item to review available impact assessment methodologies that relate to water.

## The future of water reporting

The value of water measurement at the process and site level is well-established and illustrated by case studies in this publication. The application of corporate water use metrics in higher-level business risk assessment is relatively recent, and perhaps most advanced in the agri-food sector<sup>44</sup>. Best practice should shed light on the potential value of the consolidated, weighted water footprint at the company level.

In regard to embodied water and water footprinting it is clear that the concepts and approach are rapidly developing. There is a clear move forwards from the reporting of water inputs and use, through to water consumption and most recently, to water scarcity. This brings problems, as the issues of water availability vary widely from country to country, region to region, and at a more local level, even from river to river. As it is the issue of water scarcity and availability which is at the heart of the concern about water, then gaining a better understanding of how to measure impact is important. However, as with all methodologies which are still in development, it will be some time before conclusions are reached.

For construction products, there will be continued consolidations and harmonization across Europe to align to the existing water indicator in the European Standard EN 15804 for Environmental Product Declarations measuring net usage of freshwater in m<sup>3</sup> but with the knowledge that this does not account for issues such as water scarcity or water quality. The process of incorporating the thinking from the ISO Water Footprinting Standard (ISO 14046:2014) will take some considerable time.

<sup>42</sup> <http://shop.bsigroup.com/ProductDetail/?pid=000000000030250082>

<sup>43</sup> <http://www.bsigroup.co.uk/en-GB/ISO-14046-Water-footprint--Principles-requirements-and-guidelines/>

<sup>44</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/312961/Water\\_Abstractions\\_release\\_final\\_20.05.14.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/312961/Water_Abstractions_release_final_20.05.14.pdf)

## Annexe I: Environmental product declarations (EPD) and related standards

While most established European EPD schemes have an indicator relating to water use or consumption, there is some variation in approach and implementation, described below.

**BS EN 15804:2012** *Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products*

The European Standard provides the common rules which should be used for assessing construction products in Europe. As a European Standard, it should be used as the basis of relevant regulation in any Member State, and as such, would be the basis for any relevant reporting under the Construction Products Regulation Basic Works Requirement 3 and 7. It has been adopted by most existing construction EPD programmes within Europe as the basis for their own Product Category Rules.

As of 2014, the standard requires the reporting of **“Net use of fresh water”** in m<sup>3</sup>, though no further guidance is given within the standard. However, CEN TC 350, the technical committee which developed the standard, established a Discussion Forum for queries in relation to the implementation of the standard which includes guidance on the reporting of Net use of fresh water (copied in Annexe 2) and is developing a guidance document.

### **CEN TC 350 Discussion Forum**

The TC350 Discussion Forum during 2014 received a number of queries about the reporting of the “Net use of fresh water” indicator and has provided guidance via the Forum website: [http://portailgroupe.afnor.fr/public\\_espacenormalisation/CENTC350/forum.html](http://portailgroupe.afnor.fr/public_espacenormalisation/CENTC350/forum.html) and which is copied in Annexe 2.

**ECO Platform** <http://www.eco-platform.org>

The ECO Platform, set up in 2012/13 by all the European construction EPD programmes, aims to work towards harmonised implementation and mutual recognition of construction EPD across Europe.

### **BRE EN 15804 Environmental Profiles Methodology (2013): Net use of fresh water (m<sup>3</sup>).**

No specific guidance has been provided on the measurement of this resource indicator. See [www.greenbooklive.com](http://www.greenbooklive.com).

### **IBU EPD to ISO 14025 (issued prior to 2013) – Water utilisation (m<sup>3</sup>)**

Some pre-2013 EPD provide data on water consumption (Wasserbedarf) within chapter 8.2 of the EPD, in a part called water utilisation (Wassernutzung in German). For data see <http://bau-umwelt.de>. No guidance is provided on the calculation of these results.

### **IBU EPD to ISO 14025 and EN 15804: Use of net fresh water (m<sup>3</sup>)**

Use of fresh water resources is reported in the table of resource indicators (Einsatz von Süßwasserressourcen in German). For data, see <http://bau-umwelt.de>. No guidance has been provided on the calculation of these results but this is normally “blue water consumption”.

### **FDES (French EPD): Water Consumption – withdrawals (litres)**

All FDES to XP P01-010 (see <http://www.base-inies.fr/Inies/Consultation.aspx>) provide information on water consumption classified by source (lakes, sea, rivers, mains water; ground water etc.) in section 2.1.3 of the FDES, Consommation d'eau (prélèvements).

L'Association des Industries de Produits de Construction (AIMCC) provides the following guidance<sup>45</sup> on the reporting of Water in FDES.

- For water consumption (surface water; groundwater; mains water etc), take into account:

The water used in processes: e.g. the water used by a hydraulic binder; water for the production of steam or water required for a chemical process

The evaporated water in cooling towers and water to compensate for purges of the cooling systems.

<sup>45</sup> [http://www.moquette-ufm.com/intranet/spip/IMG/pdf/ENV09669\\_DE\\_Vademecum\\_AIMCC\\_ACV-FDES\\_version\\_validee\\_septembre\\_2009.pdf](http://www.moquette-ufm.com/intranet/spip/IMG/pdf/ENV09669_DE_Vademecum_AIMCC_ACV-FDES_version_validee_septembre_2009.pdf)

- Note:

The cooling water flow in a closed circuit is not taken into account.

The water intake for cooling or irrigation activities for agriculture are to be considered on a case by case basis depending on the point of withdrawal and the point of release.

### **BRE Environmental Profiles 2008 methodology: Water Extraction Indicator (m<sup>3</sup>)**

This earlier BRE EPD scheme is still in operation alongside BRE's EN 15804 compliant EPD scheme, and uses the same methodology as the BRE Green Guide Online ([www.bre.co.uk/greenguide](http://www.bre.co.uk/greenguide)). The methodology<sup>46</sup> states:

- This category includes all water extraction, except:

Seawater;

Water extracted for cooling or power generation and then returned to the same source with no change in water quality (water lost through evaporation would be included in the impact category),

Water stored in holding lakes on site for recirculation (top-up' water from other sources would be included),

Rainwater collected for storage on site.

Quantitative water data for products and elements can be found by looking at Certified Environmental Profiles on BRE Global's Greenbooklive.com website. Qualitative results for generic constructions are provided in the Green Guide Online, [www.bre.co.uk/greenguide](http://www.bre.co.uk/greenguide).

---

46 [http://www.bre.co.uk/filelibrary/greenguide/PDF/Environmental\\_Profiles\\_Methodology\\_2007\\_-\\_Draft.pdf](http://www.bre.co.uk/filelibrary/greenguide/PDF/Environmental_Profiles_Methodology_2007_-_Draft.pdf)

## Annexe 2: Advice on water measurement in EPD from technical committee TC 350<sup>47</sup> Date extracted December 2014

Net Use of Fresh Water should follow the approach of the international standard on Water Footprinting (BS ISO 14046:2014 Environmental management - Water footprint — Principles, requirements and guidelines)

### **Fresh Water - Definition from ISO DIS 14046:2013**

Water having a low concentration of dissolved solids.

**Note 1:** Freshwater typically contains less than 1000 milligrams per litre of dissolved solids and is generally accepted as suitable for withdrawal and treatment to produce potable water.

**Added Note 2:** Moisture and crystal water in natural materials (like wood, clay, soil, etc.) is not fresh water.

### **Drainage Basin - Definition from ISO DIS 14046:2013**

Area from which direct surface runoff from precipitation drains by gravity into a stream or other water body.

**Added Note 1:** Fossil water is ground water that has a negligible rate of natural recharge on a human timescale. Use of fossil water is considered fresh water consumption by default.

### **Water Use - Definition from ISO DIS 14046:2013**

Use of water by human activity

**Note 1:** Use includes, but is not limited to, any water withdrawal, water discharge or other human activity within the drainage basin including in-stream or in situ uses such as fishing, recreation, transportation.

### **Water Consumption - Definition from ISO DIS 14046:2013**

Water removed from but not returned to the same drainage basin (3.1.8).

**Note 1:** Water consumption can be because of evaporation, transpiration, product integration or discharge into a different drainage basin or the sea. Evaporation from reservoirs can be included in water consumption.

EN 15804 uses the term “net” (as opposed to gross) in relation to freshwater use, to show:

- the intention that use of water which it is not consumed (eg. water used for river transport, used to power hydroelectric turbines or used as coolant and returned to the original source) should not be considered within the indicator
- That water which would have been lost from the original, natural system, eg. from evaporation of rainwater or from a body of water is not considered within the losses from the studied technical system
- Evaporated fresh water is considered consumption unless it is demonstrated otherwise

For each process, the water flows should be identified, in terms of volume extracted, volumes discharged and the source or the destination, eg. surface water; ground water; sea water.

Where tap water (water from the public grid) is used, the water treatment and distribution system should be considered as an upstream process which will have its own resource use and discharges. Similarly, where water is discharged to the sewer, then the sewer and water treatment system should be considered as a downstream process with its own resource use and discharges.

Other water flows, for example water which evaporates or water which is incorporated into the product, should ideally be itemised in the process inventory so that a full water balance can be made.

For each process, the water consumed is the sum of the water which is lost from a drainage basin. This may be more easily calculated as the sum of water which evaporates, transpires from biomass, is incorporated into products or is discharged to a different drainage basin. This also, as mentioned, does not need to account for water which would have been lost from the drainage basin in the natural system before the technical system was implemented.

**Example:** Rainwater would normally be expected to drain to surface or ground water. If a factory or building is placed on the site, then water may instead be directed to the sewer and may be discharged, after treatment, to the sea, surface or ground water. Water which is diverted through the water treatment system from its original drainage basin is consumed. If rainwater is used in the building before discharging it into the sewer then this will be considered no differently than if the water was discharged directly to the sewer. However, if rainwater is used for cleaning and evaporates, then this water is consumed.

---

<sup>47</sup> [http://portailgroupe.afnor.fr/public\\_espacenormalisation/CENTC350/forum.html](http://portailgroupe.afnor.fr/public_espacenormalisation/CENTC350/forum.html) answers on EN 15804

**Example:** For an agricultural process, water that evaporates or transpires from the plants as a result of human activity (irrigation) is considered as consumption. Water such as rainwater which evaporates or goes to the drainage basin in the same way it would if there was no agricultural process is not consumption. The assumption is that natural vegetation would have the same effect.

**Example:** Additional water evaporation from reservoirs and as a result of the hydrogeneration process downstream which occurs in addition to that from the original natural system will be considered water consumption.

**Example:** For a quarry, where dewatering takes place, if this water is returned to the same drainage basin it would naturally have drained to, then it is not consumption. If however; it is used in a process and evaporates, then it is consumption.

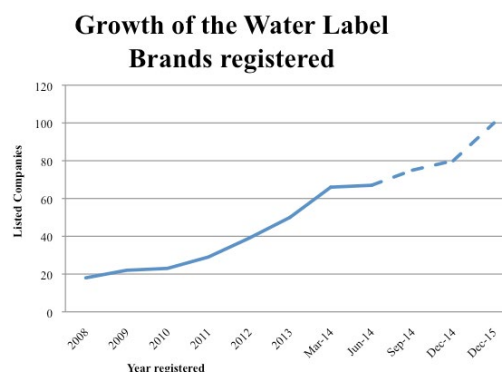
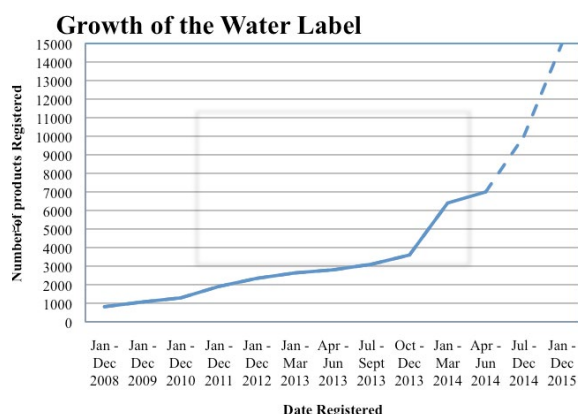
## Annexe 3: Guidance for the householder on ways to reduce water usage

There have been a number of EU and UK sponsored initiatives to assist householders to reduce water usage and to help them identify products to purchase that are efficient on water use.

**The European Water Label<sup>48</sup>** was first introduced by industry into the UK in 2007 and by 2014 was visible on products in 32 countries. Its purpose is to enable customers to readily identify water efficient products available on the market. The Label has been introduced across Europe and covers all major water using products in the home (with the exception of white goods – washing machines and dishwashers).

In July 2013, leading DIY retailers and builders' merchants in the UK announced a collective agreement to roll out the labelling across full product ranges for showers, taps, toilets and baths. A cross-industry group supported by the government agency WRAP, in response to the Government's Water for Life White Paper<sup>49</sup>, undertook to look at the role the sector could play in reducing water demand through increasing sales of lower water using bathroom fittings. The expansion of the Water Label into other European countries was happening at the same time.

More information can be found at <http://www.europeanwaterlabel.eu/home.asp>



<sup>48</sup> <http://www.europeanwaterlabel.eu/home.asp>

<sup>49</sup> Defra (2011) Water for Life <http://www.official-documents.gov.uk/document/cm82/8230/8230.pdf>

**The Water Energy Calculator**<sup>50</sup> is an online tool in the UK to help households to understand their water use and identify potential savings. It has created an extensive information resource on domestic water devices and behaviour. (Source: Energy Saving Trust (2013) At Home with Water<sup>51</sup>).



50 <http://www.energysavingtrust.org.uk/Heating-and-hot-water/Saving-money-on-water/Water-Energy-Calculator>

51 <http://www.energysavingtrust.org.uk/About-us/The-Foundation/At-Home-with-Water>



